

CLEAN COAL TODAY

A NEWSLETTER ABOUT INNOVATIVE TECHNOLOGIES FOR COAL UTILIZATION

PROJECT NEWS BYTES

A one-million-ton SynCoal® production celebration was held in June at the **Rosebud Syncoal Partnership's Advanced Coal Conversion Process Clean Coal Technology Demonstration** facility in Colstrip, Montana. Invited were plant and mine employees, SynCoal® customers, the Department of Energy, and others having made a significant contribution to the success of the plant. The one-million-ton milestone was accomplished with no lost time accidents in well over 300,000 man hours. The project has been a major boost to local and regional economies, producing over \$8.5 million in wages, \$2 million in production taxes, \$18 million in materials and supplies purchases, and

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LPMEOH™ DEMONSTRATION PRODUCES FIRST METHANOL FROM COAL

— DEDICATION HELD IN JULY —

Principal Deputy ASFE Robert S. Kripowicz and FETC Director Rita A. Bajura were on hand July 25, 1997, for a dedication ceremony at the Liquid Phase Methanol (LPMEOH™) Demonstration Project, recognizing the start of testing of a unique commercial facility for producing methanol from coal. They were joined by Stanley M. Morris, Vice President, Technology, and James F. Strecansky, Vice President and General Manager, Process Systems & Equipment Division, Air Products and Chemicals, Inc., and by Edward C. Horton, Vice President, Industrial Intermediate Business Organization, and Jerry R. Repass, Vice President, Tennessee Eastman Division, Eastman Chemical Company. The speakers echoed a theme of government and industry partnerships investing together in a long-term commitment for success. Noting that the LPMEOH™ technology is the result of almost two decades of government-sponsored bench-scale and pilot plant development by Air Products, Kripowicz stated, "There is no better answer to those who question the benefits of government and industry investing together in tomorrow's technology than the facility we are dedicating today."



This project demonstrates at a commercial scale the LPMEOH™ process to produce methanol from coal-derived synthesis gas.

The Energy Department's Federal Energy Technology Center (FETC) manages this commercial demonstration of the LPMEOH™ process under a cooperative agreement with Air Products Liquid Phase Conversion Company, L.P., a partnership between Air Products and Eastman. The project was selected in the third round of the Clean Coal Technology Program. This scale-up of the LPMEOH™ process is based on over 8,000 hours of operation by Air Products in DOE's 3,200 gallon-per-day pilot scale liquid phase reactor facility in LaPorte, Texas. LPMEOH™ technology was developed to enhance the economics and efficiency of integrated coal gasification com-

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.... LPMEOH™ continued

bined cycle (IGCC) power generation by producing a clean burning, storable liquid (methanol) from the clean coal-derived gas during periods of low power demand. Together, these technologies will be able to fill local needs for electric power, transportation fuels, and manufactured chemical products.

Operation of the LPMEOH™ Demonstration Unit commenced in early April at Eastman's integrated coal gasification facility in Kingsport, Tennessee, with immediate success. The demonstration unit quickly achieved one of its initial performance targets by producing methanol at a rate of 80,000 gal/day, confirming the 25-to-1 size scale-up of the liquid phase reactor. In its first five weeks of operation on coal-derived synthesis gas, the demonstration unit has logged over 700 hours of stable operation — a unit availability of 92.9 percent when the gasifier is on-stream. A continuous operating period of over 14 days was also achieved. The next operational goal at the facility is to maximize methanol production beyond 80,000 gal/day, as designed, and to demonstrate long-term catalyst life operating with the coal-derived synthesis gas.

Operations on coal-derived synthesis gas resumed on June 17, 1997, following a scheduled maintenance outage. Since operations resumed, the demonstration unit has been operating continuously on coal-derived synthesis gas with only one minimal interruption to accommodate a gasifier changeover. For the second month, the demonstration unit again logged over 700 hours of stable operation with a unit availability of 100 percent. Another highlight during this period was the on-line addition of fresh catalyst slurry to the reactor. Since operations began in April,

Eastman accepted over 3 million gallons of product methanol for use in its commercial chemical synthesis.

The demonstration's novel process combines the reaction and heat-removal systems by suspending the catalyst in a liquid phase that quickly removes the heat of reaction away from the catalyst surface. This distinguishes LPMEOH™ from other commercial methanol-production processes that send synthesis gas through a fixed bed of dry catalyst particles. The excellent heat management capability of the liquid phase reactor provides a significant improvement, particularly for methanol catalysts where strict temperature control is needed.

In contrast to fixed beds, the liquid phase is comprised of micron-size, temperature-sensitive methanol catalyst suspended in an inert mineral oil. Because of superior heat management capability, the LPMEOH™ reactor can directly handle carbon monoxide-rich synthesis gas typically produced in modern gasifiers.

IGCC technology is being demonstrated in four other Clean Coal Technology Program project sites as one of the cleanest and most efficient of 21st century power-generating options. LPMEOH™ technology strengthens the IGCC option and provides cost savings by allowing the manufacture and sale of two products: electricity and methanol. Based on recent economics, a commercial-scale, 426-MWe IGCC co-production facility could also manufacture 152,000 gal/day of methanol at a cost of about 45-50 cents per gallon. This compares favorably to new world-scale chemical-grade methanol plants (producing 700,000 to 900,000 gal/day) that have a U.S. Gulf Coast delivered cost of 55-60 cents per gallon.

Construction of the LPMEOH™ demonstration facility began in October 1995 and was completed in January 1997 at a cost of \$35 million. The project's four-year operational period will demonstrate technical feasibility and gain commercial acceptance of the LPMEOH™ technology. A carefully developed test plan will allow LPMEOH™ facility operations at Kingsport to simulate the typical electric power demand cycles in coal-based IGCC facilities. The LPMEOH™ process can take advantage of periods of low electricity power demand by producing and storing methanol, which is immediately available to generate electricity when the utility faces its next period of high power demand. This step will increase utilization of gasifier capacity and lower utilities' costs. The operations also will demonstrate enhanced stability and heat dissipation of the conversion process, its reliable on/off operation when the cyclical power demand decreases and increases, and its ability to produce methanol suitable for use as a fuel without additional upgrading. The methanol could then be used to fuel gas turbines during peak demand.

Joining Air Products and Eastman are Acurex Environmental Corporation (providing co-funding and methanol fuel testing services), and the Electric Power Research Institute (providing guidance for commercial acceptance). While Eastman will use most of the methanol produced as a chemical feedstock on site, methanol product testing will be conducted to demonstrate how a centrally located clean coal electric power plant with methanol co-production could provide energy services to local communities.

COMMERCIAL REPORT

GNOCIS SOFTWARE COMMERCIALIZING GLOBALLY



There soon will be nine installations of Generic NO_x Control Intelligence System (GNOCIS), developed by the Electric Power Research Institute. GNOCIS was tested by Southern Company Services, Inc. (SCS) under the U.S. DOE Clean Coal Technology (CCT) Program at Georgia Power Company's Plant Hammond. Other partners in development of the software are Radian International, PowerGen (a major U.K. utility), and the U.K. Department of Trade and Industry.

GNOCIS is an on-line artificial intelligence software tool that was designed to provide recommendations to achieve NO_x reductions at power plants in a manner consistent with economic and operational constraints of the plants. While it was developed and demonstrated on coal-fired boilers, GNOCIS can operate on units burning gas, oil, or coal, and potentially is applicable to all combustion applications and other processes such as non selective catalytic reduction (SNCR). GNOCIS utilizes a neural-network model of combustion characteristics of the boiler, which reflects both short- and longer-term trends. An optimizing procedure is applied to identify the best set points for the plant. The recommended set points are then relayed to plant operators in either an advisory (open-loop) configuration, which requires an operator decision, or in a supervisory (closed-loop) manner, where the set points can be implemented automatically without operator intervention.

In 1996, GNOCIS testing at the 500-MWe wall-fired Hammond Unit 4 was conducted in both open-loop-advisory and closed-loop-supervisory modes, and represented one of the first applications of artificial intelligence for wide-scale power plant control. Initial results at full load showed that absolute boiler efficiency increased by one-half percent, unburned carbon in the flyash (UBC) decreased by 1-3 percent, and NO_x emissions decreased by 10-15 percent relative to reduction achieved using low-NO_x burners and advanced overfire air system also installed as part of the CCT project demonstration.

GNOCIS is projected to reduce NO_x emissions by 10-35 percent from the baseline emission level in a wide range of boilers while meeting other site-specific operational constraints, such as UBC and furnace exit gas temperature. Following the successful demonstration of GNOCIS at Plant Hammond, several U.S. utilities committed to additional demonstration projects and commercial applications, and the project team is commercializing the software both here and abroad. By year's end, the project team anticipates about two dozen installations in the United States, and the team is negotiating several installations in foreign countries.



GNOCIS was developed at Georgia Power Company's Plant Hammond to optimize the low-NO_x techniques developed in the CCT Program.

NCC TOUTS FUTURE ROLE OF COAL

The National Coal Council (NCC), a private, nonprofit advisory body, which provides guidance and recommendations to the Department of Energy (DOE) on coal policy matters, recently released a report which concludes that coal use is directly linked to U.S. growth and prosperity. The report, "Vision 2020: The Role of Coal in U.S. Energy Strategy," examined the long-range role of coal in fulfilling a vital portion of the nation's future energy needs. NCC was asked to define how coal can continue to be a fuel source for producing low-cost electricity. At the same time, NCC was to identify the potential impediments that would keep the coal industry and our nation from realizing that goal, and ways that industry and DOE could overcome those impediments.

According to NCC, there are many misconceptions about coal. The report probes the positive contribution coal can make to help the nation meet its future energy, economic, and environmental objectives.

Key Findings — The report highlights a number of important facts concerning energy consumption, and factors affecting coal use in the U.S. energy mix:

- Consumers in the United States demand low-cost electricity; and demand is growing about 2 percent per year.
- Over 55 percent of electricity comes from coal-fired sources, and low-cost electricity is the direct result of using low-cost coal.
- Coal use provides benefits including jobs, a competitive economy, a high standard of living, and less dependence on imported oil.
- Modern use of coal is clean and efficient when used in conjunction with clean coal technologies developed through the DOE Clean Coal Technology Demonstration Program. Using these technologies has increased efficiencies and decreased emissions.
- More stringent environmental programs and global climate change policies are being proposed that would restrict or reduce the use of coal; if enacted, NCC predicts that such measures would put our energy independence and perhaps the U.S. economy at risk.

Next Steps — Based on its findings, the NCC makes 11 recommendations to the coal industry and DOE to promote continued use of coal "for the benefit of our nation's energy independence," and to meet the demands of U.S. consumers for low-cost electricity in the future:

- DOE and the coal industry should support and encourage continued generation of low-cost electricity regardless of fuel type.
- DOE and the coal industry should encourage use of technologies that will expand coal's benefits in producing electricity, transportation fuels, and chemicals, to reduce imports of oil and natural gas.
- DOE and the coal industry should continue collaborative RD&D efforts for coal-fueled technologies for repowering and new plants.
- DOE should lead the effort to develop energy policies and regulations with sound scientific bases and which are economically justified, environmentally acceptable, and strategically consistent. Equally important is expanding outreach to educate the public about how new coal-fueled facilities are clean, efficient, and utilize technologies that protect the environment.
- DOE should work closely with federal, regional, state, and local environmental agencies to ensure that environmental policies and regulations

are based on sound scientific principles and use least-cost control methods to minimize delivered cost of electricity.

- DOE should take a lead role in scientific review of global climate change and formation of related policy to ensure that coal is not "disadvantaged."
- DOE should facilitate and support development and application of mid-term and long-term coal technologies that are very efficient and have very low emissions, such as electro-technologies, and exploration of technologies that use coal along with other domestic fuels such as solid waste or biomass.
- DOE should, in partnership with industry, promote the use of highly efficient coal-fueled technologies in developing countries.
- In partnership with industry, DOE, the U.S. Agency for International Development (USAID), and the U.S. Department of State should encourage use of clean coal technologies as a leading source of power generation in foreign development.
- DOE should study the effects of eliminating taxes, fees, and policies that inhibit competitiveness of U.S. coal internationally, and encourage enforcement of trade agreements that promote use of U.S. coal by foreign nations.
- DOE and the Department of State should work together on foreign policy formation to ensure that energy directives do not run counter to domestic economic concerns and negatively impact on jobs, and the delivered price of electricity among other things.

The NCC represents more than 30 states, and a broad spectrum of interests from business, industry, and other groups. For information about NCC or a copy of "Vision 2020: The Role of Coal in U.S. Energy Strategy," contact the National Coal Council, P.O. Box 17370, Arlington, VA 22216, phone: 703-527-1191.

SECOND GENERATION COAL GASIFICATION TECHNOLOGY

STARTUP AND OPERATIONS PHASE IN PIÑON PINE IGCC PROJECT

The Department of Energy (DOE) applauded startup of the nation's third advanced coal gasification combined cycle power generating system demonstration project — at a Reno, Nevada, power plant — 16 months after the first operational IGCC project was dedicated in Indiana.

The \$336 million Clean Coal Technology Program partnership, known as the Piñon Pine Integrated Gasification Combined Cycle (IGCC) Power Project, has begun the startup and operation phase at a commercial size using M.W. Kellogg Company's KRW air-blown gasification technology and hot gas cleanup for pollutant control. Sierra Pacific Power Company is hosting the project at its Tracy Station in Reno, Nevada.

The two earlier DOE IGCC projects — the Wabash River Coal Gasification Repowering Project in Indiana and the Tampa Electric Integrated Gasification Combined Cycle Project in Florida — began testing in 1995 and 1996, respectively.

DOE announced that it approved cost-sharing for the operational phase of the Piñon Pine IGCC project, effective February 1, 1997. DOE's share for this phase will be \$52 million, or 50 percent of the \$104 million cost. The plant is currently completing hot shakedown and startup of all systems. The power island continues to operate in a natural gas combined cycle mode in order to provide heat and steam for use in the gasifier island.

As currently built, the state-of-the-art power plant will convert up to 880 tons per day of western bituminous coal to syngas to generate nominally 100 megawatts (gross) of electric power. The Tracy Station also currently houses three oil/gas-fired steam units and four gas turbines.

The "second generation" gasification combined cycle technology, used in the Piñon Pine Project, offers advantages that could reduce costs and improve performance of coal gasification-based power systems. The Piñon Pine Project uses air-blown fluidized bed technology, which is less costly and provides a higher thermal efficiency than oxygen-blown entrained bed technology. A second potential advantage is the advanced hot gas cleanup system that removes more than 98 percent of the sulfur with a regenerative sorbent in a transport reactor. This reactor comprises a series of tubes that pneumatically moves the gases and the solid sorbents through the reactor system together while mixing them, in transport, thus reducing the amount of sorbent required.

The advanced hot gas cleanup system also uses ceramic filters for high efficiency particulate capture. All of these steps are accomplished without significant cooling of the product gas stream. Additionally, the system's inherent modular design and relatively simple process configuration are expected to lower engineering and construction costs of future commercial

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Sierra Pacific will demonstrate an air-blown, fluidized-bed gasifier with hot gas clean up at the Piñon Pine CCT project.

.... Piñon continued

plants. All this leads to higher overall efficiencies: 40-45 percent for IGCC compared to 33 percent for a coal-fired power plant with a conventional scrubber.

Development of the KRW gasification process dates back to 1972 when DOE first funded design and construction of a 25 ton/day pilot plant at Westinghouse Electric Corporation's Waltz Mill facility near Madison, Pennsylvania. The pilot plant ran for more than 10 years, demonstrating successful operation of the air blown fluid bed gasification process on a variety of coals, in-bed desulfurization, and operation with ceramic filters and external hot gas desulfurization.

In the KRW system, crushed coal and limestone are metered through lockhoppers (a type of valve for handling solids while maintaining high pressure), and fed pneumatically into the bottom of a pressurized gasifier. The bed temperature is controlled by regulating the flow of air and steam into the gasifier. Gas recirculation maintains the coal/limestone mixture in a fluidized state, allowing the limestone to effectively control sulfur gaseous compound emissions. Ash and spent limestone are removed from the bottom of the reactor.

The coal gas passes through a transport reactor that contains a rapidly recirculating and regenerable bed of fine, sulfur-specific solid sorbent particles, which capture any remaining traces of hydrogen sulfide. Coal gas is finally passed through an array of solid ceramic candle filters that remove almost all particulates, leaving a hot, clean gas for power generation.

Cleaned hot coal gas then is sent to a General Electric Model 6FA combustion turbine that produces 61 megawatts (gross) of electricity. Exhaust air from this turbine is

delivered to a compressor to pressurize the gasifier. This turbine also is capable of operating on natural gas when the gasifier is not operating. Exhaust gases from the turbine flow through a heat recovery steam generator to lower gas pressure down to atmospheric levels in a non-reheat steam turbine, which then generates another 46 megawatts (gross) of electric power.

The Piñon Pine project could be replicated in its 100-megawatt (net) size, or built as a series of modules in a larger plant consistent with the



Aerial view of Piñon Pine IGCC with raw coal storage dome in foreground and the gasification and power island in background.

choice of selected larger turbines. The plant would be able to burn a variety of high ash, high sulfur, or low rank coals.

Foster Wheeler USA Corporation has designed and constructed the overall plant with significant assistance from M.W. Kellogg on the gasification island sections. The three-and-one-half year operating phase will demonstrate process performance, and system availability and reliability on both high-and low-sulfur coals. Subsequently, the plant will be operated commercially and serve as a prototype for utilities and other power generators in the 21st century.

STATE CCT ACTIVITIES



MISSISSIPPI SUPPORTING INNOVATIVE ECO-INDUSTRIAL COMPLEX



As part of the Mississippi Lignite Project (MLP), a program administered by the Mississippi Department of Economic and Community Development to encourage coal projects in the state, a plan is under way to establish the Red Hills EcoPlex, an eco-industrial park (EIP). Thus far, Red Hills, located in Central Choctaw County, will house a lignite mine; a circulating fluidized bed cogeneration unit firing lignite and biomass, which will provide power to the Tennessee Valley Authority; and a newsprint pulp plant (mill). Other targeted possible occupants for the growing industrial park are companies that could use the carbon dioxide emissions or the calcium sulfate (gypsum). Targeted industries include hydroponic greenhouses, poultry processing, aquaculture facilities, or a plant that processes kenaf (a rapid growing plant that is used in making pressboard and other paper products). Phillips Coal Company of Dallas, Texas, and CRSS of Houston, Texas are the project's sponsors.

Red Hills EcoPlex is the first "greenfield" EIP complex in the country, and possibly in the world, according to the MLP. The objective of an EIP is to maximize consumption of energy and materials and to minimize wastes by using by-products of one operation as feedstocks in another. This is designed to reduce costs, increase productivity, and expand sources of revenue, while reducing overall emissions. In the case of Red Hills, the newsprint manufacturer's plant will use steam produced at the electric generating plant, and the power plant will in turn utilize the wood waste (pulp) sludge from the newsprint plant by burning it as a fuel source.

The newsprint manufacturer is scheduled to begin operation in 1998, and the lignite mine and power plant are planned for the year 2000 or 2001, at which time the newsprint plant will tie in to the power plant's system. The combined cost is approximately \$1 billion. Construction of the EcoPlex will employ between 1,000-1,200 people. After construction, 500-525 people will be employed; 100-125 in the power plant and the lignite mine, and up to 400 people in the newsprint mill.

NORTH DAKOTA FUNDING CCT ACTIVITIES

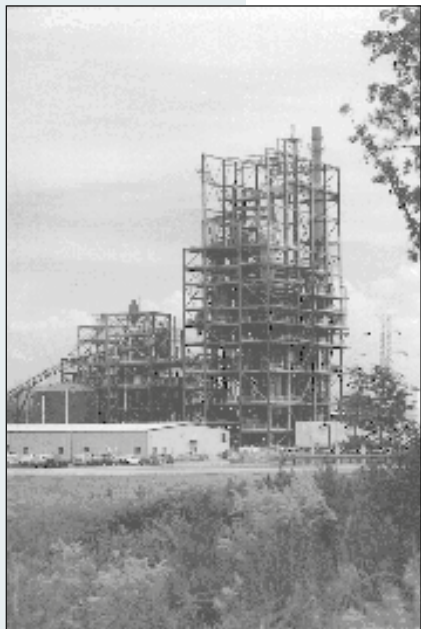


In August, the Industrial Commission of North Dakota, Lignite Research, Development and Marketing Program approved \$6 million in clean coal demonstration funds to help the Dakota Gasification Company develop a pipeline project to capture, compress, and transport carbon dioxide from the Great Plains Synfuels Plant near Beulah to an oil field near Weyburn, Saskatchewan. Through the project, Dakota Gasification Company will sell approximately two million tons of carbon dioxide (CO₂) each year from the Great Plains Synfuels Plant to PanCanadian, operator of the Weyburn oil field, who will use the CO₂ for enhanced oil recovery. The funding includes a \$4 million equity investment and a \$2 million grant for this two-year project, which has a total cost of \$107 million. North Dakota sees the pipeline project as benefiting the lignite industry and helping to preserve the economic base provided by the Great Plains Synfuels Plant, 5,150 full-time direct and indirect jobs, \$494 million in economic benefits, and \$19 million in annual state tax revenues. In addition, the project will create both construction and permanent jobs and provide an important market for CO₂. The Commission also approved funding for "Evaluation of Market Potential for North Dakota Flue Gas Desulfurization Gypsum," a study to be conducted by EN-ROCK Inc. of West Fargo, North Dakota, in cooperation with Cooperative Power, Eden Minnesota. This study will assess markets for gypsum manufactured from the flue gas desulfurization by-products at the Coal Creek Station at Underwood, ND. The Commission approved funding for half of the \$47,000 project.

POWER SYSTEMS DEVELOPMENT FACILITY

THE FOCUS OF DOE RESEARCH AND DEVELOPMENT ON ADVANCED POWER SYSTEMS

Construction is well under way on Foster Wheeler's advanced pressurized fluidized bed combustion (PFBC) pilot-scale system at the Power Systems Development Facility (PSDF), located at Southern Company Services' Clean Coal Research Center near Wilsonville, Alabama. Simple cycle operations are expected late this year on the system, which incorporates a coal-derived, fuel gas-fired topping combustor. The advanced PFBC system is a major part of the joint industry/DOE facility which tests components (either individually or in an integrated fashion) of tomorrow's coal-based power generation systems. The PSDF incorporates a number of related pilot-scale projects at a single site and greatly reduces capital and operating costs compared to individual stand-alone facilities. The facility will provide a focal point essential to an integrated program and a test site for addressing reliability and cost parameters of advanced coal-based power systems under long-term and realistic conditions.



Wilsonville Power Systems Development Facility is the site of major advanced energy research..

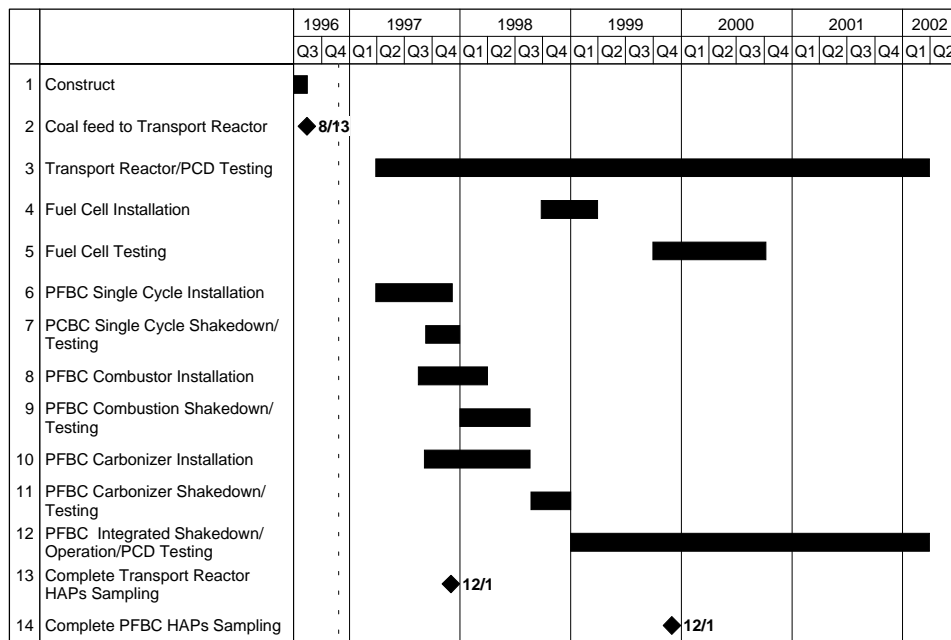
The second major system at Wilsonville is M.W. Kellogg's transport reactor technology, a generic coal conversion reactor coupled to a Westinghouse particulate control device (PCD), which became partly operational in late 1996.

The current thrust of activities at the PSDF is development of devices to remove particulates from high-temperature, high-pressure gas streams in coal gasification and PFBC power plants. In 1998, efforts will focus on continuing operations of the transport reactor system and hot gas PCDs to support the IGCC program, and establishing stable operation of the advanced PFBC pilot plant. Development of high-temperature, high-pressure PCDs is necessary to extend the lifetime of downstream components to acceptable levels.

DOE has invested \$125 million in the facility to date, with industry sharing some 20 percent of project costs. Southern Company Services, Inc. is the PSDF prime contractor. Other team members are: M.W. Kellogg (transport reactor), Foster Wheeler (advanced pressurized fluidized bed combustion system), Southern Research Institute (gas stream sampling probes), Westinghouse (low-NO_x topping combustor and two candle filter systems), Combustion Power Corporation (moving granular bed filter), Industrial Filter and Pump (candle filter system), and the Electric Power Research Institute (technical expertise and cost sharing).

Foster Wheeler's second generation PFBC uses a fluidized-bed carbonizer to partially convert coal to a fuel gas. The remaining char is combusted in a circulating PFBC. The coal feed rate to the carbonizer is 5,500 pounds/hour. The hot gases coming off the carbonizer and PFBC are cleaned by different PCDs, and then go to a topping combustor. High-temperature exhaust gases from the topping combustor will be used in a commercial process to power an advanced gas turbine with a high-firing temperature to improve overall system efficiency.

POWER SYSTEMS DEVELOPMENT FACILITY SCHEDULE



The transport reactor, which provides either an oxidizing or reducing gas at high pressure and temperature, is intended for parametric testing of hot gas cleanup systems under gasification or combustion conditions. The coal feed rate is 3,200 pounds/hr under gasification conditions. Beyond PCD testing, this advanced gasifier/combustor may also be used to test a desulfurizer and a fuel cell on gas from a hot gas cleanup system.

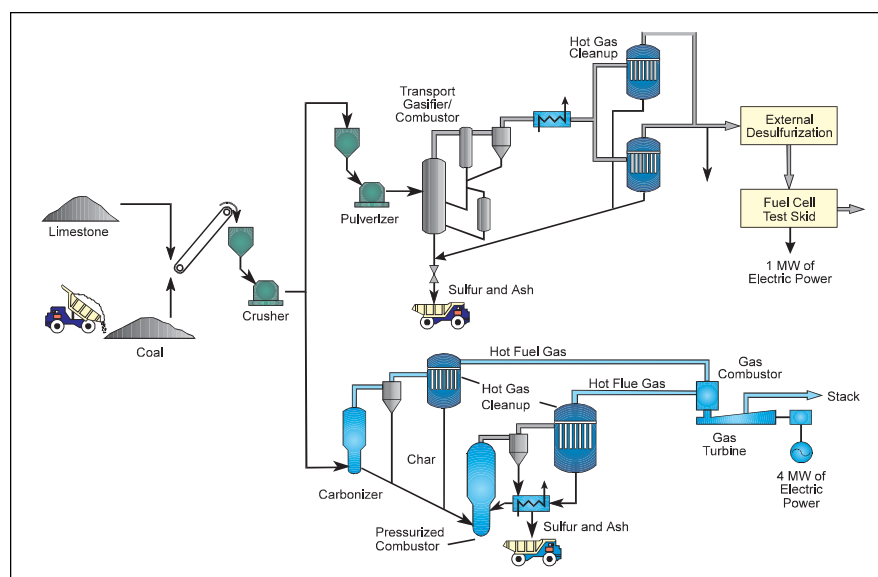
Alabama bituminous coal was fed to the transport reactor last August, and several shakedown runs have been completed with low temperatures in the PCD. Additional combustion runs are scheduled at higher PCD temperatures and to test the Combustion Power Company's granular bed filter prior to the transport reactor's conversion to gasification conditions. The Westinghouse PCD will be switched to the PFBC carbonizer after first testing under gasification conditions in the transport reactor. Later in the program, other PCDs of similar size

will be tested to allow for interchanging between the PFBC carbonizer and the transport reactor.

Plans are being made to eventually integrate a molten carbonate or solid oxide fuel cell, initially sized at 100 kW, with a transport reactor using EPRI's 100-kW Fuel Cell Test Skid.

Provision has been made in the site layout to phase in a MW-size fuel cell module with commercial stacks utilizing the gases from the transport gasifier. At this scale, testing can begin to address integration issues and overall plant performance for integrated gasification/fuel cell systems. A hot gas desulfurization facility will be needed between the transport reactor gas outlet and the inlet to the fuel cell test skid. The fuel cell requires gas containing less than 1 ppm H₂S.

The time required to develop new coal-based technology for electric power production can easily exceed 10 years, and the expense can be well beyond what any one company can reasonably afford. The PSDF provides a highly flexible, large-scale, cost effective test center where industry and government can work to further the goal of providing high-efficiency, low emissions, low-cost coal power generation for the 21st century.

POWER SYSTEMS DEVELOPMENT FACILITY
CONSISTS OF TWO SEPARATE REACTOR SYSTEMS

INTERNATIONAL INITIATIVES

DOE SIGNS FOSSIL ENERGY ANNEX WITH ITALY



In May 1997, the U.S. Department of Energy (DOE) and the Italian Ministry of Industry, Commerce, and Handicraft (MICA) signed Annex III to the original Memorandum of Understanding (MOU) to cooperate in various fields of energy R&D. The MOU was signed in 1985 and was followed by an Implementing Agreement in 1990. After these expired, a third agreement in 1995 renewed both countries' commitment to technology information exchange and made general provisions for joint R&D and planning, to be defined in later annexes. Annexes I and II, dealing with intellectual property and security obligations, helped to resolve legal barriers to full cooperation, and allow Annex III a narrower focus specifically targeted toward fossil energy R&D. Annex III reinforces both parties' interest in clean coal research, development, and demonstration technologies; environmental protection; energy security; and international trade. Joint activities could include technical evaluations and assistance, exchange of technical and economic data and technology transfer, cooperative projects, site visits, and training and internship programs.

DOE-UKRAINE CLEAN COAL TASK FORCE

In order to assist Ukraine with its power shortage following the Chernobyl accident, DOE and Ukraine established a Clean Coal Task Force in 1994 to introduce western technology to refurbish existing coal-fired electric generating capacity. Increasing efficiency, capacity, availability, and use of indigenous resources were among the goals, as well as lowering emissions and reducing electricity costs. DOE received \$2.5 million from the U.S. Agency for International Development (AID) to support this effort. The task force chose the Lugansk Power Station as a case study to assess the costs and benefits of alternative ways to upgrade an existing power plant. During the course of the study, the World Bank decided to consider the possibility of a loan to refurbish Lugansk, and recently agreed to prepare a Project Concept Document, the first step in their loan approval process.

One of the eight 200-MW boilers at Lugansk would be refurbished to burn specification coal, while two new 62.5-MW circulating fluidized bed boilers would burn waste fuel. A new wastewater treatment facility would be installed for the entire plant as well as an upgraded fuel handling system. Under the scenario developed by the Task Force, the World Bank would loan 60 percent of project costs.

The Bank has asked DOE to expand the scope of the project and conduct additional tasks to demonstrate that the project is the "least cost" for the entire Ukrainian system. The Bank would like to see an Independent Power Producer (IPP) as an investor and would be willing to make the loan if the owner is credit worthy. Under the Bank's plan, DOE would find an interested IPP to study the Lugansk situation and tell the present owner what terms and conditions would be necessary to effect a sale.

While the Bank believes the project can lower costs and help the Ukrainian economy improve, it is skeptical that the project can be financed by conventional means given the weakness of the Ukrainian economy.

DOE SUPPORTS BRAZIL'S QUEST FOR COAL

Following over a year's effort, during which Fossil Energy's Office of Coal and Power Import and Export (ImEx) provided significant guidance, support, and advice, the Draft Brazilian Coal Policy was unveiled at the Brazilian Public Forum on Coal Policy Workshop, in Rio, Brazil, this past April. ImEx facilitated development of the Coal Policy with the Brazilian Ministry of Mines and Energy, and Brazilian industry. The Workshop and discussions leading up to the Policy focused on privatization, deregulation, restructuring, clean coal technologies, and information on how we cooperate regionally in the United States. Also discussed have been the fundamentals of how utilities operate in the United States on a day-to-day basis, providing invaluable insight to Brazil as it moves through privatization.

The Brazilian Coal Policy was developed by a Task Force established last June by Brazilian Energy Minister, Peter Greiner, to expand coal's portion of Brazil's thermal electric generating capacity. The Policy sets near-, mid-, and long-term opportunities to use coal-based power systems and establishes the principle that coal will be in the energy mix of the country. Currently, Brazil relies on hydro for 97 percent of its electric capacity, and many believe that gas imports will not be sufficient to meet Brazil's expanding power needs. Since Brazil reports significant indigenous coal resources, expanded use of coal would have positive economic impacts, particularly in the southern coal-producing states. Coupled with new, improved, and advanced power systems, coal has the potential to meet new demand while satisfying environmental requirements. Discussions at the Workshop focused on near-term business opportunities, in particular, the upcoming program to test and characterize Brazilian coals at U.S. laboratories, where data will be obtained on performance under different technologies. This program is anticipated to demonstrate compatibility of Brazilian coals with U.S. industrial applications. Such results will be used as a basis for attracting private investment in coal-fired power plants using Brazilian coal resources.

To further advance Brazil's Coal Policy, Coal and Power ImEx will sponsor a meeting with Brazil this fall in Atlanta, Georgia, for the purpose of sharing information on near-term business opportunities. Plans also are under way, in conjunction with the U.S. Trade and Development Agency, to host a visit to the United States by Brazilian mining experts later this fall, promoting mutually beneficial opportunities to Brazilian engineers to better familiarize them with U.S. coal mining technologies, and to introduce them to U.S. consultants, mining equipment manufacturers, and coal mining companies interested in potential joint ventures.

ExIm is in the process of negotiating a Memorandum of Understanding that will encourage agreements to cooperate in the field of coal and power systems. Supporters note that as Brazil's energy sector opens to private investment, there will be many opportunities to introduce new energy technologies.

INDIA COAL WASHING PLANT RECEIVES ACCOLADES



Workers prepare foundation at the Bilaspur Coal Washery Project in Madhya Pradesh, India.

The Bilaspur Coal Washery Project in the state of Madhya Pradesh — India's first private commercial coal washery for electric power generation — broke ground in April and was honored at official receptions in New Delhi at the Ambassador's residence and in Washington, DC, at the Indian Embassy. Speakers from both governments and U.S. Congressmen applauded its benefit to both the United States and India, given that India has large quantities of high-ash power plant coal and very little coal cleaning. The joint venture between Spectrum Technologies of Schenectady, NY, CLI Corporation of Pittsburgh, and Bombay Suburban Electricity Supply (BSES) of Mumbai, India, will include a U.S. Agency for International Development (USAID)-funded coal beneficiation R&D unit. FETC-Pittsburgh has provided technical support to USAID and has been integral in implementation of the project since its conception over three years ago.

The commercial plant will process 2.5 million tons of raw coal from the Southeastern Coal Fields Ltd. Dipka mine, and is located on mine property. Coal ash contents range from 38 to 45 percent and the washery guarantees a reduction to 32 percent. The R&D unit is intended to reduce ash levels to as low as 25 percent (unprecedented for India), both economically and with minimal loss of carbon. Overall, the washery will remove 200,000 tons of ash annually, greatly reduce disposal costs for the end user (the 500-MW BSES power plant), and lighten the

load on its electrostatic precipitator system. BSES also would save money on transportation in that the washed coal contains a higher ratio of carbon to ash per ton of coal transported. Use of washed coal also improves boiler efficiency and availability, while reducing auxiliary power requirements. Improvements in the plant performance at BSES are expected to lower CO₂ emissions by over 80,000 tons/year.

The new washery has potential to be a major business activity in India for both CLI and Spectrum Technologies, with discussions under way on at least four other potential projects.



Dr. David Hess (center) of the USAID-New Delhi visited the Bilaspur Washery Project in June 1997.

INTERNATIONAL NEWS BYTES

In June, representatives of Fossil Energy participated in a two-day conference on modern coal-burning methods (primarily fluidized bed combustion) held near the Trinec Steelworks in Ostrava, Czech Republic. Previously, the U.S. Agency for International Development (USAID) supported and FE managed a study to reduce emissions at the Trinec Steelworks. FE also managed other projects for USAID in the Czech and Slovak Republics, as well as in Bulgaria. The seminar was sponsored by Czech Trinec Steelworks, and organized by the Tech Transfer Network (TTN).

Created in 1995, TTN was always envisioned as becoming self-sustaining. USAID is closing its office in the Czech Republic at the end of September, and will no longer provide funding for TTN. To replace USAID support, TTN hopes to attract other sponsors to fund its outreach work for developing markets in the Czech Republic, Slovakia, and lower Poland. For more information, contact: Venanc Walder, Director, TTN, phone, +420 69 6604-304.

In June, DOE hosted a delegation of energy specialists from the Slovak Republic interested in advanced power generation and related technologies for possible application in their country, and making contact with potential U.S. investors. DOE arranged site visits and meetings with U.S. companies, with the result that two companies are now pursuing project opportunities.

In July, eight Chinese visitors took time away from FE's Advanced Coal-Based Power and Environmental Systems Conference in Pittsburgh to visit FETC to discuss acid mine drainage (AMD) treatment and abatement. FETC's Environmental Science and Technology Division provided a presentation on water treatment and the application of the DOE-patented "In-Line Aeration and Neutralization System" (a water treatment system operated by water pressure), and the application of geophysical techniques for AMD abatement and remediation. The visitors are interested in using this new technology to address national environmental problems associated with mining operations.

Dr. C. Lowell Miller, Director of FE's Office of Coal Fuels and Industrial Systems, participated in an international conference, "Adding Value to Coal," sponsored by CoalTrans Conferences Ltd., held in Rotterdam in June. Miller spoke on "Innovative Coal Preparation Technologies — A Significant Factor in the Future Use of Coal" regarding the DOE's coal preparation program and the need for aggressive technology innovation worldwide to ensure coal's future prominence. The conference convened leading experts on coal preparation and utilization, as well as equipment manufacturers. Attendees demonstrated particular interest in the effect of environmental concerns on coal specifications; use of heterogeneous feedstock (i.e., mixing coal with other carbon-containing materials); and recovery of coal fines. The consensus was that developing countries have strong motives to pursue coal preparation, but there is insufficient knowledge of advances being made in this area through DOE's R&D program.

.... *New Bytes continued*

\$40 million in construction costs. The plant uses a patented SynCoal® Technology to improve the heating quality of low-rank coals, primarily for utility boiler applications, but the product has other industrial uses as well, especially in cement, manufacturing and metallurgical processes. The plant's first production was in April 1992; commercial operations began in August 1993.

The NEPA process has been completed for the **Alaska Coal-Fired Diesel Generator Project** at the University of Alaska. An environmental assessment has been completed and a Finding of No Significant Impact was signed on May 30.

Construction of the **Healy Clean Coal Project**, also in Alaska, is over 98 percent complete. Operations are expected to begin next January. NO_x performance testing for the retrofitted Unit 1 (low-NO_x burners with over-fire air) is planned.

DOE's role in the **ENCOAL® Mild Gasification Project** was completed in July. ENCOAL® has found a partner with whom to continue operations. Goals for the project were not only met, but exceeded, with 16 unit trains of Process Derived Fuel (PDF™) shipped and successfully burned at six utilities. The Liquids-From-Coal™ process has been demonstrated and improved, both through operational refinements and equipment modifications. Almost five years of operating data have been collected for a basis to evaluate and design a commercial plant. Finally, licensing efforts have reached an international level: agreements have been signed and many opportunities are being developed.

FE UNVEILS VISION 21 CONCEPT FOR CLOSING CARBON CYCLE

Speaking at the July Energy Daily Conference, "Coal and Electric Power: Forging a New Partnership," Assistant Secretary for Fossil Energy Patricia Fry Godley addressed the challenges of "Coal in a Competitive Electric Market," indicating that improved technology is the path to a prosperous economy, a cleaner environment, and a reliable, affordable energy supply. Godley touched on DOE's "Vision 21" concept for the year 2015, a revolutionary fleet of clean, efficient energy complexes that utilize coal, and produce a variety of fossil energy-based commodities including electricity and clean fuels. The Vision 21 fleet would be 65 percent efficient compared to today's 35 percent, be comparable in cost to today's state-of-the-art plants, have a low life cycle electricity cost, near-zero criteria pollutants, and no net CO₂ emissions.

Dr. Howard Feibus, FE Director of Advanced Research, filled in the details on Vision 21, which is part of FE's strategic plan now under development. While there is no fixed design for a Vision 21 plant, it would likely involve a gasifier producing syngas that subsequently would be made into elemental hydrogen (H₂) to supply a fuel cell or a heat exchanger/thermal power cycle. Coal refineries are also envisioned. CO₂

would be separated on the site of the Vision 21 plant using membrane separation technology now under development, and sequestered off-site at a cost as low as \$15-20 per ton.

While Vision 21 requires advanced research breakthroughs, Feibus considers it credible because the modules that comprise it have long been part of DOE's technology portfolio. Familiar components would include: high temperature, high pressure gasifiers, and high-temperature heat exchangers, as well as such commercial systems as a bottoming cycle and an oxygen generator. Subsystems would be modular and capable of being installed in short order, enhancing competitiveness in a regulatory environment.

Existing plants could also be retrofitted in a variation of the Vision 21 plant should it become necessary to control CO₂ within the next decade. A synthetic fuel, having less carbon than current hydrocarbon fuels, would be exported from the quasi-Vision 21 plant and used as a retrofit fuel to reduce emissions of CO₂ and other pollutants from existing fossil-fired facilities.

For copies of Pat Godley's speech, please contact Peggy Abrahamson (202-586-0507). For a copy of Dr. Feibus' speech, call 301-903-4348.

STATUS OF CCT DEMONSTRATION PROJECTS

ADVANCED ELECTRIC POWER GENERATION

DMEC-1 Ltd. Partnership—*PCFB Demonstration Project*. In combination with the **Four Rivers Energy Partners, L.P.**—*Four Rivers Energy Modernization Project*, these projects have been restructured and re-sited to Lakeland, Florida. Foster Wheeler, gave the City of Lakeland a turn-key proposal to build a greenfield PCFB plant at Lakeland's McIntosh Power Plant. The City of Lakeland and Foster Wheeler are negotiating the price and terms of an agreement to proceed with the PCFB plant. (Lakeland, FL)

The Ohio Power Co.—*Tidd PFBC Demonstration Project*. The project ended December 31, 1995. DOE released the Final Report and will close out the project after a final audit. (Brilliant, OH)

Tri-State Generation and Transmission Association, Inc.—*NUCLA CFB Demonstration Project*. The project was completed April 1992. Final Report was issued. (Nucla, CO)

York County Energy Partners—*ACFB Demonstration Project*. Discussions are under way with a major utility to re-site this project. (Site pending)

Clean Energy Partners, L.P.—*Clean Energy Demonstration Project*. Discussions are under way to re-site this project. (Site pending.)

Sierra Pacific Power Co.—*Piñon Pine IGCC Power Project*. Sierra Pacific is still in the start-up and commissioning phase. Miscellaneous start-up problems have been resolved and the project is expected to achieve full start-up and operations by early October. (Reno, NV)

Tampa Electric Co.—*Tampa Electric Integrated Gasification Combined-Cycle Project*. The plant achieved 80% availability during the high demand months of July and August. Pittsburgh #8 and Kentucky #11 have been burned successfully. (Mulberry, FL)

Wabash River Joint Venture—*Wabash River Coal Gasification Repowering Project*. So far in 1997, the plant has produced over twice as many syngas megawatt-hours as it produced for all of 1996. (West Terre Haute, IN)

Alaska Industrial Development and Export Authority—*Healy Clean Coal Project*. Construction is over 98 percent complete. The erection of structural steel, the on-site fabrication and installation of equipment, painting, site landscaping, and paving activities are complete. Insulation of the combustors and related piping is being completed. The boiler was fired on oil, and using the steam produced, the turbine was loaded to produce five megawatts of electricity. The startup and commissioning of the remaining plant systems is underway. Construction remains scheduled for early completion this September. Unit No. 1 has been restarted and performance testing of the low-NO_x burners and over-fire air system is planned. (Healy, AK)

Arthur D. Little, Inc.—*Coal-Fueled Diesel Engine Demonstration Project*. In August, DOE approved Budget Period 2 and 3 for construction and operation of the project. The NEPA process—an EA and FONSI—has been completed. (Fairbanks, AK)

Pennsylvania Electric Co.—*Externally Fired Combined-Cycle Demonstration Project*. Project ended May 31, 1997. Close-out activities have begun. (Warren, PA)

ENVIRONMENTAL CONTROL DEVICES

The Babcock & Wilcox Co.—*Demonstration of Coal Reburning for Cyclone Boiler NO_x Control*. The project is complete. The Final Report has been received. (Cassville, WI)

The Babcock & Wilcox Co.—*Full-Scale Demonstration of Low-NO_x Cell Burner Retrofit*. The project was completed in September 1995. The Final Report was issued. (Aberdeen, OH)

Energy and Environmental Research Corp.—*Evaluation of Gas Reburning and Low-NO_x Burners on a Wall-Fired Boiler*. Testing was completed in December 1995. The Final Report was issued. (Denver, CO)

Southern Company Services, Inc.—*Demonstration of Advanced Combustion Techniques for a Wall-Fired Boiler*. Long-term testing of the advanced overfire air (AOFA), low-NO_x burners (LNB), and combined LNB+AOFA systems are complete. Final testing of GNOCIS in a closed-loop

configuration is continuing. The project has been extended until October 1997 to allow completion of GNOCIS testing and evaluate GNOCIS for SNCR application. (Coosa, GA)

Southern Company Services, Inc.—*Demonstration of Selective Catalytic Reduction Technology for the Control of NO_x Emissions from High-Sulfur, Coal-Fired Boilers*. The project testing was completed in December 1995. An Economic volume and the three-volume Final Technical report are available from National Technical Information Service (NTIS). (Pensacola, FL)

Southern Company Services, Inc.—*180-MWe Demonstration of Advanced Tangentially-Fired Combustion Techniques for Coal-Fired Boilers*. The project was completed in June 1994. Final Report was issued. (Lynn Haven, FL)

AirPol, Inc.—*10-MWe Demonstration of Gas Suspension Absorption*. The project was completed in June 1995. Final Report was issued. (West Paducah, KY)

Bechtel Corporation—*Confined Zone Dispersion Flue Gas Desulfurization Demonstration*. The project has been completed and the Final Report was issued. (Seward, PA)

LIFAC-North America—*LIFAC Sorbent Injection Desulfurization Demonstration Project*. The Final Report is in preparation. (Richmond, IN)

Pure Air on the Lake, L.P.—*Advanced Flue Gas Desulfurization Demonstration Project*. Project operations are complete. Final Report was issued. (Chersterton, IN)

Southern Company Services, Inc.—*Demonstration of Innovative Applications of Technology for the CT-121 FGD Process*. The Final Report is in preparation. (Newnan, GA)

ABB Environmental Systems—*SNOX™ Flue Gas Cleaning Demonstration Project*. The project was completed in October 1995. Final Report was issued. (Niles, OH)

The Babcock & Wilcox Co.—*LIMB Demonstration Project Extension and Coolside*

Demonstration. The project was completed in November 1992. Final Report was issued. (Lorain, OH)

The Babcock & Wilcox Co. – *SO_x-NO_x-Rox Box™ Flue Gas Cleanup Demonstration Project.* The project was completed in September 1995. The Final Report was issued. (Dilles Bottom, OH)

Energy and Environmental Research Corp. – *Enhancing the Use of Coals by Gas Reburning and Sorbent Injection.* Testing was completed for both Illinois Power, Hennepin Station, and City Water, Light & Power, Lakeside Station. The Final Report is in preparation. (Hennepin and Springfield, IL)

New York State Electric & Gas – *Milliken Clean Coal Technology Demonstration Project.* Mist Eliminator testing and ESP Upgrade Evaluation were completed in October 1996. Reports are in preparation and are scheduled to be released in March 1997. Heat pipe performance test report is being prepared and should be released in late Spring 1997. Design Coal testing of the scrubber is currently on hold due to a disruption of the supply of high sulfur coal. Testing will resume by early Fall 1997. (Lansing, NY)

New York State Electric & Gas – *Micronized Coal Reburning Demonstration for NO_x Control.* Construction at the Kodak site is complete. The system is undergoing startup and shakedown. Formal testing should start in early Spring 97. The modifications for deep stage burning of micronized coal for part 1 of the demonstration at Milliken Station is complete. Burner simulation was accomplished in March/April 1997. Testing was accomplished in May 1997. Modifications for part 2 of the demonstration, injector distribution, should begin in early Fall 1997. (Lansing, NY and Rochester, NY)

NOXSO Corporation – *Commercial Demonstration of the NOXSO SO₂/NO_x Removal Flue Gas Cleanup System.* Construction of the liquid SO₂ facility has been completed and is in startup and shakedown. The host site was lost, and discussions are ongoing with a major utility to resite this project. (Site pending)

Public Service Company of Colorado – *Integrated Dry NO_x/SO₂ Emissions Control System.* Testing of the new urea injection lance system has been completed. Integrated testing of the sodium injection system in conjunction with the urea system has also been accomplished. The Final Report for the project is in preparation. (Denver, CO)

COAL PROCESSING FOR CLEAN FUELS

CQ Inc. and ABB Combustion Engineering, Inc. – *Coal Quality Expert.* CQE was released in December 1995 and is now being offered commercially. The Draft Final Report has been reviewed and is being edited. (Homer City, PA)

Custom Coals International – *Self Scrubbing Coal™: An Integrated Approach to Clean Air.* The plant has temporarily halted operations due to financial and environmental constraints. Negotiations are continuing toward a restart of the plant. The plant has processed over 650,000 tons of raw coal and shipped over 400,000 tons of clean coal product. (Central City, PA; Martins Creek, PA; Richmond, IN; Ashtabula, OH)

Rosebud SynCoal® Partnership – *Advanced Coal Conversion Process (ACCP) Demonstration.* The ACCP facility continues to process raw subbituminous coal, producing over 1 million tons of SynCoal® product to date. Nearly 870,000 tons of SynCoal® product has been supplied to customers, including industrial (primarily cement and lime plants) and utilities. SynCoal® product continues to be supplied to Units 1 and 2 of Montana Power's Colstrip Power Station. (Colstrip, MT)

ENCOAL® Corp. – *ENCOAL® Mild Coal Gasification Project.* ENCOAL® continues to operate the plant in a production mode while completing several Final Reports. ENCOAL® continues to seek domestic opportunities for a large-scale commercial plant. (Gillette, WY)

Air Products Liquid Phase Conversion Company, L.P. – *Liquid Phase Methanol Process Demonstration Project.* Startup and the first methanol production from the LPMEOH™ Process Demonstration Facility occurred on April 2, 1997. Design production capacity of 80,000 gallons per day was attained on April 6, 1997, and production rates as high as 115 percent of design have been achieved. Unit availability has exceeded 92 percent since startup. All

methanol produced at the LPMEOH™ Process Demonstration Facility has been accepted by Eastman Chemical Company for use in downstream chemical processes. (Kingsport, TN)

INDUSTRIAL APPLICATIONS

Bethlehem Steel Corporation – *Blast Furnace Granulated Coal Injection System Project.* Bethlehem Steel Corporation continues to operate two commercial blast furnaces retrofitted with Blast Furnace Granulated Coal Injection equipment at modest injection rates while continuing to evaluate various coals and operating conditions. (Burns Harbor, IN)

CPICOR™ Management Company, L.L.C. – *Clean Power from Integrated Coal/Ore Reduction (COREX®).* DOE representatives met with CPICOR™ team members as an initial step in the NEPA process. DOE will issue a Notice of Intent for preparing an Environmental Impact Statement on this project when the technical baseline is firmly established. (Vineyard, UT)

Coal Tech Corp. – *Advanced Cyclone Combustor with Internal Sulfur, Nitrogen, and Ash Control.* The project was completed in September 1991. The Final Report has been received. (Williamsport, PA)

Passamaquoddy Tribe – *Cement Kiln Flue Gas Recovery Scrubber.* The project was completed in February 1994. Final Report was issued. (Thomaston, ME)

CLEAN COAL TODAY

Published quarterly by:
The Office of Fossil Energy

U.S. Department of Energy (FE-24)
Washington, DC 20585

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TWO CCT TECHNOLOGIES WIN INDUSTRY AWARDS

In May, the Tampa Electric Polk Power Station, a state-of-the-art integrated coal gasification combined cycle power plant co-funded under the CCT program, was selected as one of Power Magazine's 1997 Powerplants of the Year. A month later, the Air and Waste Management Association presented the J. Deane Sensenbaugh award to DOE, the Gas Research Institute, and the U.S. Environmental Protection Agency for their role in developing gas reburning technology.

The Power Magazine award is the fifth to a CCT project in the last seven years. The 250-MWe Tampa Electric project, dedicated in January 1997, is located near

Mulberry in central Florida, and is the first greenfield demonstration of IGCC in the country. The plant uses an oxygen-blown Texaco gasifier integrated with a General Electric frame 7F combined cycle plant. IGCC technology is modular and fuel flexible, and is capable of removing 95 percent of sulfur pollution



Tampa Electric Company's award-winning IGCC power plant near Mulberry, Florida, has been operating at near 40-percent efficiency during early commercial operation.

and producing saleable by-products. Additionally, its near-40 percent efficiency results in reduced emissions of CO₂ greenhouse gases.

The reburning technology honored by the A&WMA is applicable to both coal- or oil-fired boilers and uses natural gas to create a "reburn" zone inside the combustor to convert nitrogen oxides to environmentally benign nitrogen. DOE cost-shared full-scale tests of the technology at Illinois Power Company's Hennepin Station in Hennepin, Illinois; City Water, Light, and Power Co.'s Lakeside Station in Springfield, Illinois; and Public Service Company of Colorado's Cherokee Station in Denver. The technology has now crossed the commercial threshold with four installations in the U.S. and one overseas.

UPCOMING MEETINGS

SEPTEMBER 23-27, 1997

14th Annual International Pittsburgh Coal Conference & Workshop,

Taiyuan, Shanxi, People's Republic of China. Sponsored by Shanxi Energy Research Society, University of Pittsburgh, DOE/FETC, Institute of Coal Chemistry, Chinese Academy of Sciences. For information, contact Christine M. Zarnich, University of Pittsburgh, 412-624-7440.

OCTOBER 28-30, 1997

APEC Experts' Group on Clean Fossil Energy Fifth Annual Seminar

"Clean Fossil Energy: The Choice for Today and Tomorrow," Reno, Nevada. For information, contact Jean Lerch, 202-586-7920 (e-mail jean.lerch@hq.doe.gov).

NOVEMBER 18-20, 1997

International Symposium on Clean Coal Technology — Coal Processing, Utilization, and Conversion,

Xiamen, Fujian, People's Republic of China. Sponsored by Ministry of Coal Industry, P.R. China, and U.S. Department of Energy. For information, contact the Conference Secretariat, China Coal Research Institute, +86-10-64212752.

APRIL 28-MAY 1, 1998

Sixth Clean Coal Technology Conference, Reno, Nevada. For information, contact Jean Lerch, 202-586-7920 (e-mail jean.lerch@hq.doe.gov).